CLAIMS

What is claimed:

1. A method of making a catalyst comprising:

providing a porous, hydrothermally-stable support, wherein the support comprises carbon;

contacting the support with a sol comprising metal oxide particles;

adding a catalyst component; and

drying;

wherein the porous, hydrothermally-stable support is directly contacted with the sol comprising metal oxide particles.

2. The method of claim 1 wherein the metal oxide particles comprise an oxide of a metal or metals selected from the group consisting of: Ti, V, W, Hf, Ta, Nb, Mo and W.

3. The method of claim 2 wherein the metal oxide particles comprise colloidal sized particles.

4. The method of claim 1 wherein the catalyst component is in an aqueous suspension, and wherein the metal oxide particles and the catalyst component are coprecipitated.

5. The method of claim 1 further comprising, subsequent to the step of adding the catalyst component, reducing the catalyst component.

6. The method of claim 1 wherein the sol comprising metal oxide particles is in an aqueous solution having a pH between 1 and 6.

7. The method of claim 6 wherein the sol comprises a colloidal suspension

8. A method of conducting a catalyzed reaction under hydrothermal conditions, comprising:

passing at least one reactant into a reaction chamber;

wherein the reactant is in an aqueous solution, wherein the aqueous solution has a pH;

wherein the reaction chamber comprises a catalyst;

wherein the catalyst was made by forming a sol of a metal oxide at a pH that is within 2 of the pH of said aqueous solution; adding a catalyst metal; and depositing the metal oxide and the catalyst metal onto a porous, hydrothermally-stable support;

reacting the at least one reactant in the presence of the catalyst and under hydrothermal conditions; and

obtaining at least one product from the reaction chamber;

wherein the product obtained has a higher purity or a higher yield than where the reaction is conducted at a pH that is 4 or more from the pH of said aqueous solution.

9. The method of claim 8 wherein the aqueous solution has a pH between 1 and 6.

10. The method of claim 8 wherein the reaction occurs in a temperature range of 120 °C to 260 °C.

11. A method of conducting a catalyzed reaction under hydrothermal conditions, comprising:

passing at least one reactant into a reaction chamber;

wherein the reactant is in an aqueous solution;

wherein the reaction chamber comprises a catalyst;

wherein the catalyst comprises:

a porous, hydrothermally-stable support;

a metal oxide deposited on the support; and

a catalyst component;

reacting the at least one reactant in the presence of the catalyst and under hydrothermal conditions; and

obtaining at least one product from the reaction chamber.

12. The method of claim 11 further comprising a second reactant added to the reaction chamber in a nonaqueous solvent.

13. The method of claim 11 wherein the step of reacting occurs in a temperature range of 120 °C to 260 °C.

14. The method of claim 11 wherein the step of reacting occurs at a pH of 1 to 6.

15. The method of claim 11 wherein the reactant is completely dissolved in aqueous solution.

16. The method of claim 11 further comprising addition of hydrogen gas to the reaction chamber.

17. The method of claim 16 wherein the reactant comprises succinic acid.

18. The method of claim 11 wherein the support comprises carbon, and wherein the metal oxide comprises one or more of Zr, Ti, Hf, Ta, Nb, Mo, and W.

19. A textured catalyst comprising:

a hydrothermally-stable, porous support comprising a porous interior and an exterior surface;

a metal oxide; and

a catalyst metal;

wherein the porous support has a minimum, smallest dimension of at least about 100 μm; at least about 70% of the catalyst component is within about 5 μm of the minimum area that encompasses about 80% of the metal oxide; and

wherein at least about 5% of the catalyst component is at least about 10 μm from the exterior of the support.

20. The catalyst of claim 19 wherein the support comprises carbon, and wherein the metal oxide comprises one or more of Zr, Ti, Hf, Ta, Nb, Mo, and W.

21. The catalyst of claim 19 wherein the catalyst is made by a process in which the catalyst component and metal oxide are coprecipitated.

22. The catalyst of claim 19 wherein the catalyst component is fully reduced.

23. The catalyst of claim 19 wherein the support is hydrothermally-stable such that it loses less than 5% of its surface area after 72 hours in water at 150 °C.

24. The catalyst of claim 23 comprising carbon particles.

25. The catalyst of claim 19 wherein the metal oxide comprises 5 to 10 weight percent of the dried catalyst and wherein the metal oxide comprises at least 90%, by mass, of an oxide or oxides of one or more of Zr, Ti, Hf, Ta, Nb, Mo, and W.

26. The catalyst of claim 25 wherein the catalyst component comprises 0.1 to 10 weight % of an element selected from the group consisting of Pd, Ru, Rh, Pt, Re, Ni, Cu, Au, Ag, Co, Fe, Os, and Ir.

27. The catalyst of claim 25 wherein the metal oxide comprises zirconia or titania and the catalyst component comprises Pd or Rh.

28. The catalyst of claim 19 wherein at least about 70% of the catalyst component is within about 2 μm of the minimum area that encompasses about 80% of the metal oxide

29. The catalyst of claim 19 wherein at least 10% of the metal oxide is located at least about 20 μm away from the exterior of the support.

30. A method of making a chemical product comprising reacting at least one reactant over the catalyst of claim 19.

31. The catalyst of claim 19 wherein the 80% of metal oxide plus 5 μm margin occupies less than 40% of the total cross-sectional area.

32. The catalyst of claim 19 wherein at least 80%, of the metal oxide is within about 5 μm of the minimum area of 80% of the catalyst component.

33. A catalyst made by the method of claim 1.

34. The catalyst of claim 19 wherein at least 50% of the catalyst component is within about 10 μm of the exterior of the support.

35. The catalyst of claim 19 wherein the support comprises internal pores and wherein some internal pores have at least 2 times as much of the catalyst component as compared with the metal oxide.

36. The catalyst of claim 19 the majority of catalyst component that is located at least about 10 μm of the exterior of the support is located in pores having at least one dimension of at least about 5 μm.

37. The method of claim 2 wherein the support is impregnated with the sol comprising metal oxide particles, and then dried to remove water.